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A NONMANNITOL-FERMENTING TYPE OF S. ENTERITIDIS PRODUCING CLINICAL REACTIONS SIMILAR TO THOSE OF ROCKY MOUNTAIN SPOTTED FEVER VIRUS

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During the summer of 1931 an epizootic occurred among our stock guinea pigs (at the National Institute of Health), killing many of them. The disease in the guinea pig was characterized clinically by fever only. Post-mortem examination showed rather marked congestion of the abdominal viscera, with a spleen enlarged two or three times, darker than normal, and smooth. While febrile, some of these animals were bled from the heart and culture medium was inoculated with the whole blood. In this way there was isolated a strain of *S. enteritidis* which differed from the strains of *S. enteritidis* that have been described in that it failed to ferment mannitol. After more than 1 year from the date of isolation, the nonmannitol-fermenting characteristic of this organism persisted. For the purpose of this discussion, this strain of *S. enteritidis* will be referred to as *S. enteritidis* 288. A description of this organism follows:

Gram-negative motile rod with peritrichous flagella; grows readily on ordinary culture media; in broth grows readily at room temperature and luxuriantly at 37.0° C.; produces a faint yellow growth on potato in 24 hours; does not liquefy gelatin nor produce indol; hydrogen sulphide is produced in 24 hours; reduces nitrates; in litmus milk it produces acid in 24 hours, less acid in 48 hours, and in 96 hours the milk is alkaline.

Fermentation reactions.—Acid and gas in the monosaccharides, arabinose, rhamnose, xylose, galactose, glucose, mannose, and levulose. In the disaccharide maltose, acid and gas are produced, while lactose, saccharose, and trehalose are unaffected. The trisaccharides, melezitose, and raffinose are unchanged. Acid is produced in the polysaccharides, dextrose, and starch; inulin is unchanged. Of the alcohols, erythretol, adonitol, inositol, and mannitol are unchanged, while acid is produced in glycerol, and acid and gas in dulcitol and sorbitol. The glucocides amygdalin and salicin are unchanged.

Serology.—A study was made of the serological relation between *S. enteritidis* 288 and two strains of *S. enteritidis*, two strains of *S. aertrycke*,

and one strain each of *S. paratyphi*, *S. schotmuelleri*, and *B. paratyphosus* C. Sera of rabbits which had been inoculated with *S. enteritidis* 288 agglutinated the *enteritidis* and not the *aertrycke* and paratyphoid organisms. *S. enteritidis* 288 was agglutinated by *enteritidis* sera and not by *aertrycke* sera.

Reaction in laboratory animals.—Male guinea pigs were inoculated both with a 24-hour-old broth culture and with a suspension of the organism. The suspensions were prepared from a 24-hour growth on agar slants and were adjusted to a turbidity of 500 parts per million. Following these inoculations the guinea pigs became febrile in from 24 to 48 hours, with maximum temperature ranging from 40° C. to 41.5° C. In addition to the febrile reaction, 25 percent of the animals had definite involvement of the external genitalia characterized by erythema and edema of the scrotum. The post-mortem examination, made in from 2 to 6 days after the onset of symptoms, showed the peritoneum injected and moist; serous fluid in the peritoneal cavity in some and purulent fluid in a few. The spleen varied from slightly to three times enlarged, was darker than normal, smooth, and covered with varying amounts of exudate. The liver was possibly slightly enlarged and darker than normal in some, and in the majority of instances was covered with a filmy exudate. The testicles were normal in size, the vessels of the tunica injected, and in a few instances there was a slight amount of exudate on the testicles.

S. enteritidis 288 could be passed in series in guinea pigs and was carried in this manner for five generations. The transfers were made with whole cardiac blood in doses of 2 or 3 cc, inoculated intraperitoneally. The reactions in the guinea pig following such inoculations differed somewhat from those produced by inoculations of pure cultures of the organisms.

Following inoculations with guinea pig passage *S. enteritidis* 288, the animals became febrile in from 2 to 6 days. The duration of the febrile period ranged from 4 to 14 days, with a maximum temperature of from 40° C. to 41° C. The scrotal lesion seen following inoculation of the pure culture occasionally occurred in guinea pigs inoculated with the guinea pig passage organism. Post-mortem examinations made on the third or fourth day of fever revealed injection of the peritoneum and a spleen enlarged three to four times, darker than normal, and smooth. No fluid or pus was observed in the peritoneal cavity. The mortality rate of guinea pigs inoculated with the guinea pig passage organism was 20 percent.

S. enteritidis 288 produces in the guinea pig a complete immunity to subsequent inoculations of the same organism.

Three rabbits were inoculated with 0.25 to 0.50 cc of a 24-hour broth culture. Each of the rabbits died within 24 hours.

Twenty-two rabbits were inoculated with guinea pig passage *S. enteritidis* 288 by means of whole cardiac blood obtained from guinea pigs in the third or fourth day of fever. The injections were made with doses varying from 3 to 8 cc of the blood. Of the 22 rabbits, 2 died too soon to determine any reaction, 14 showed no (or indefinite) reaction, and 6 responded with definite febrile reactions. One of the rabbits reacting with a definite febrile course had a marked lesion of the external genitalia characterized by erythema, œdema and ulceration of the scrotum, and enlargement of the testicles.

CONFUSION WITH ROCKY MOUNTAIN SPOTTED FEVER AND TYPHUS

At the time when the epizootic was occurring among the stock guinea pigs, experiments with the virus of the eastern type of Rocky Mountain spotted fever were in progress. The presence of this *S. enteritidis* led to confusion. (1) (2).

In the guinea pig, fever is the only clinical manifestation produced by the virus of Rocky Mountain spotted fever isolated from cases occurring in the eastern part of the country, and congestion of the abdominal viscera and enlargement of the spleen are the only gross pathological findings. Rarely erythema and œdema of the scrotum have occurred, but attempts to transmit this involvement to subsequent generations have failed.

In the rabbit the eastern virus of spotted fever produces a febrile reaction, and in some male rabbits a scrotal lesion in addition to the fever. This scrotal lesion is characterized by erythema and œdema of the scrotum which frequently progresses to ulceration and enlargement of the testicles.

From the descriptions given, it is evident that the reactions produced in the guinea pig and rabbit by *S. enteritidis* 288 simulate those produced by the eastern virus of Rocky Mountain spotted fever. The scrotal lesion produced in the guinea pig by *S. enteritidis* 288 is, in appearance, more like that produced by the virus of endemic typhus than by the western virus of Rocky Mountain spotted fever.

On account of the confusing clinical reactions in guinea pigs, the immunological relation between this strain of *S. enteritidis* and the viruses of spotted fever and typhus was studied. In testing the immunity of recovered typhus and spotted fever guinea pigs to the *S. enteritidis*, whole cardiac blood of guinea pigs infected with this organism was used. In each instance the *S. enteritidis* was recovered from the blood used in making the inoculations.

Twenty-seven guinea pigs immune either to the western virulent virus or the eastern spotted fever virus, with 49 fresh guinea pigs as controls, were inoculated with this strain of *S. enteritidis*. Seventy and three-tenths percent of the immune animals failed to react

(apparently immune), while but 8.1 percent of the fresh controls failed to react.

Thirty-two guinea pigs immune either to the endemic or epidemic typhus viruses, with 45 fresh guinea pigs as controls, were inoculated with this strain of *S. enteritidis*. Thirty-seven and five-tenths per cent of the immune animals failed to react (apparently immune), while but 6.8 per cent of the fresh controls failed to react.

When the guinea pigs immune to *S. enteritidis* were tested for immunity to the viruses of spotted fever and typhus, different results were obtained.

Nineteen guinea pigs immune to *S. enteritidis*, with 32 fresh guinea pigs as controls, were inoculated with viruses of spotted fever. Ten and five-tenths percent [3] of the immune animals failed to react, while none of the fresh controls failed to react.

Seven guinea pigs immune to *S. enteritidis*, with 14 fresh guinea pigs as controls, were inoculated with typhus viruses. None of the animals failed to react.

SUMMARY

A nonmannitol-fermenting strain of *S. enteritidis* has been isolated from the cardiac blood of guinea pigs during an epizootic.

This strain of *S. enteritidis* produces in the guinea pig and rabbit clinical manifestations similar to those produced by the virus of Rocky Mountain spotted fever isolated from cases occurring in the eastern part of the United States.

An apparently nonspecific immunity occurs between this strain of *S. enteritidis* and the viruses of Rocky Mountain spotted fever and typhus.

This apparent nonspecific immunity has occurred only when guinea pigs immune to the viruses of spotted fever and typhus were inoculated with this strain of *S. enteritidis* and not when immune *S. enteritidis* guinea pigs were inoculated with the viruses of spotted fever and typhus.

This strain of enteritidis, and perhaps other organisms, may cause confusion in isolating a strain of spotted fever or typhus virus.

REFERENCES

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[3] Not all fresh guinea pigs react to inoculations with viruses of spotted fever and typhus. In a series of 714 fresh guinea pigs, 7.2 percent failed to react to the eastern spotted fever virus, and in a series of 200 fresh guinea pigs 11 percent failed to react to a virus of endemic typhus.

EXPERIMENTAL STUDIES OF NATURAL PURIFICATION IN POLLUTED WATERS

VII. THE SELECTION OF A DILUTION WATER FOR BACTERIOLOGICAL EXAMINATIONS

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In making quantitative determinations of the number of bacteria in a sample which will grow on plates or in tubes, it is usually necessary to dilute a portion of the sample with sterile water to reduce the bacterial content to numbers which can be accurately enumerated. The dilution water may influence bacterial counts thus obtained in at least two ways: It may be bactericidal, and it may contain precipitates which will appear as confusing particles, simulating bacterial colonies on the plates, when the counts are made. Tests for the presence of such interference should be made on the water after it has been sterilized and is ready for use, as the characteristics of a water are frequently changed by sterilization.

In the first (1905) and second (1912) editions of Standard Methods for the Examination of Water and Sewage (American Public Health Association) it is stated that either sterile tap water or distilled water may be used for dilution purposes in bacteriological work. In the third edition and all subsequent editions sterile tap water is recommended and distilled water is not mentioned.

At first thought it would seem that a tap water would be ideal for bacteriological dilution. Upon careful investigation, however, only a few tap waters are found to be entirely suitable. Well, or spring, waters as a rule contain iron and a fairly large amount of mineral salts which are held in solution by carbon dioxide in the water. Precipitates are frequently formed when these waters are exposed to air, and are practically always produced by sterilization with heat. The hydrogen ion concentration of such waters may be changed sufficiently by sterilization to make them bactericidal. Tap waters derived from surface sources are not constant in their composition. They vary not only in their natural mineral salt content but also from the effects of coagulation and chlorination.

In the actual field experience of this laboratory it has frequently been found necessary either to resort to waters other than tap water or to treat the tap water before it was used for bacteriological dilution, because the available tap supply was not suitable after sterilization. For instance, the hydrogen ion concentration of Cincinnati (Ohio) tap water is ordinarily so low after autoclaving, pH 8.6 to 9.5, that it is bactericidal unless it is allowed to stand for at least 48 hours before use to give it time to reach an equilibrium with the carbon dioxide in the laboratory air. In actual practice it is allowed to

stand for 96 hours before use. At times when the excess lime treatment is employed to avoid tastes and odors, the water as it comes from the tap is in the pH zone of 9.0 to 9.5, and greater difficulties are encountered. Additional evidence indicating the changes in hydrogen ion concentrations which are produced in waters when they are autoclaved is presented in Table 1. In this table are given the pH values of the various natural and synthetic waters used in this study, as observed before autoclaving, after autoclaving and cooling, and 48 hours after autoclaving. In eight of the eleven waters examined, changes in hydrogen ion concentrations of 0.5 to 1.8 pH were observed.

TABLE 1.—*Hydrogen ion concentration of various synthetic dilution waters and natural waters before and after sterilization by autoclave*

Water or source of water	Hydrogen ion concentration expressed in pH		
	Before sterilization	After autoclaving	48 hours after autoclaving
Distilled	6.7	[1] 8.5	7.2
Bicarbonate	8.0	9.2	8.9
Phosphate	7.3	7.4	7.4
Formula C	7.3	7.4	7.4
Cincinnati, Ohio	8.1	8.6	7.6
Pine Ridge, S. D.	7.6	8.4	8.2
Lake Michigan	8.0	8.7	8.2
Charleston, S. C.	6.4	7.3	7.3
Lawrence, Kans.	7.8	8.2	8.1
Lynn, Mass.	7.0	8.5	8.2
Springfield, Ill.	7.9	8.6	8.2

[1] Distilled water changes to pH 7.2 to 7.4 within a short period after sterilization or immediately upon agitation.

Another factor that must be considered in the preparation of bacteriological dilution waters is the quality of the glassware in which the water is sterilized. Collins and Riffenburg (1925) have called attention to the dangers of pollution with materials dissolved from glass. Phosphate-buffered water, pH 7.2, autoclaved in pyrex glass containers, showed an unchanged final hydrogen ion concentration. A portion of the same water after sterilization in a bottle of poor quality glass had a pH of 8.7. Poorly buffered waters undergo still greater changes. All dilution bottles used in this study were tested by filling with distilled water, autoclaving, and then examining the water. The solution of material from glass is most rapid in distilled water. Bottles producing a persistent change in the hydrogen ion concentration of the water were not used.

Similar difficulties have been encountered in selecting a dilution water for use in biochemical oxygen demand determinations. In this instance the criterion for the suitability of the dilution water is even more exacting; for not only must the water be favorable to the continuous

viability of the biological factors concerned, but it must also be free from any substance which would add to the oxygen requirement of the sample or interfere chemically with the quantitative determination of oxygen. Considerable progress has been made toward the development of a dilution water for this purpose. Mohlman, Edwards, and Swope (1928) proposed a dilution water prepared by dissolving 0.5 gram of sodium bicarbonate per liter of distilled water. Later Mohlman (1930) has suggested that the bicarbonate content be reduced to 0.3 gram per liter. Theriault et al. (1931) have reviewed the results presented by these and other workers. In addition they made a comparative study of the oxygen demand results obtained when distilled water, bicarbonate water, and two synthetic waters (phosphate water[1] and Formula C[1] water) prepared by them were used for dilution. As a result of this study, and with a view to the eventual development of a dilution water for general use, they believe that it is desirable to standardize on the readily prepared phosphate dilution water.

As biochemical oxygen demand tests and bacteriological examintions are usually made in the same laboratory, it would be a decided step toward standardization and simplicity of operation if the same dilution water could be used for both procedures. With this object in view, a preliminary study on the selection of a suitable water has been made. In this study the results obtained with Cincinnati tap water, distilled water, bicarbonate water (300 p.p.m.), phosphate water, and Formula C water have been compared to determine the relative suitability of these waters for bacteriological dilution. In each instance the source water was also used as a sixth dilution water, that is, as each sample was received for examination a portion of it was withdrawn, measured into dilution bottles, sterilized, and used as a dilution water for that particular sample. All dilution waters except these source waters were sterilized at least 48 hours before they were used.

In making such a comparison it would be expected that some of the dilution waters might vary in their suitability, depending on the nature and the source of the water sample under examination. In order to test this possibility and to obtain information adapted for more general application, samples for examination, using these dilution

[1] The following stock solutions were used in the preparation of dilution waters:

(1) Phosphate buffer solution (34.0 grams KH_2PO_4 dissolved in 500 ml. of distilled water, adjusted to pH 7.2 with 1 M NaOH solution and made up to one liter with distilled water).

(2) Calcium chloride solution, 0.10 M (18.3 grams $CaCl_2.4H_2O$ per liter of distilled water).

(3) Magnesium sulphate solution, 0.04 M (9.9 grams $MgSO_4.7H_2O$ per liter of distilled water).

(4) Ferric chloride solution, 0.001 M (0.27 grams $FeCl_3.6H_2O$ per liter of distilled water).

Phosphate dilution water: The phosphate water was prepared by adding 1.25 ml. of stock phosphate buffer solution per liter of distilled water.

Formula C water: Formula C water was prepared by adding to each liter of phosphate dilution water stock solutions as follows: 0.1 M calcium chloride, 2.5 ml.; 0.04 M magnesium sulphate, 2.5 ml.; and 0.001 M ferric chloride, 0.5 ml.

waters, were obtained from (1) White Clay Creek, Pine Ridge Indian Agency, Pine Ridge, S.Dak.; (2) Lake Michigan, near the mouth of the Chicago River at Chicago, Ill.; (3) Goose Creek, at Charleston, S.C.; (4) Kansas River at Lawrence, Kans. (5) Saugus River watershed at Lynn, Mass.; (6) Sangamon River at Springfield, Ill., and (7) Ohio River at Cincinnati, Ohio. These are fairly representative of waters in the United States, with the exception of the extremely alkaline waters of the far West.

An attempt was made to determine the bacterial count, as observed in the various diluted samples, (1) immediately after the portion of the sample was added to the dilution water, (2) after it had been in the diluting water 15 minutes, and (3) again after a 30-minute exposure. Examinations were not made after longer periods, because in routine procedure the sample would not ordinarily remain in the dilution water for a greater time than 30 minutes before the diluted sample would be mixed with the culture medium.

METHODS

In carrying out these tests the sample was vigorously shaken, and then 1 ml. was withdrawn and added to the first dilution water. The time was noted. The mixture was then shaken vigorously and 1-ml. portions were withdrawn and placed in Petri dishes. Four plates were made of each dilution, and standardized pipettes were used. The plates were poured with agar at once and the time was noted. The diluted sample was then allowed to stand for 15 minutes before it was again vigorously shaken and portions withdrawn for plating. During this 15-minute period the process was repeated with the same sample for each of the dilution waters. The plants for the 15 and 30 minute periods were made in the same manner. The interval during which the portion of the diluted sample was in the Petri dish before agar was added did not exceed one minute. This avoided the adverse effects of sedimentation and evaporation which become a factor if portions of a sample are allowed to stand in plates for 15 minutes or over before the culture medium is added.

Three workers cooperated on each test. One acted as timekeeper, the second made the dilutions and added the 1-ml. portions to the Petri dishes, and the third looked after the agar and poured the plates.

The same agar was used throughout a given test. This agar was melted and cooled to 40° C. before the plating was started and was held at this temperature. Four plates were made of each dilution at each planting. Each count recorded in the tables represents the average of at least four plates from one dilution. The plates were cooled immediately after pouring and mixing, placed in a 37° C. incubator, and incubated for 24 hours before the colonies were counted.

Although the exposure of the organisms in the sample to the dilution water, before the addition of agar, was accurately timed, the immediate planting period did not represent a zero time exposure to the diluting water, for some time was required to mix thoroughly the portion of the sample with the water and to add the required portions to the plates. As actually observed, this period of exposure was usually 80 seconds, with an occasional variation of 10 seconds.

A possible source of error that could not be fully controlled was the change that might take place in the number of organisms in the sample during the 9 to 10 minute interval which elapsed while the portions of the sample were being added to the various dilution waters under test. While any change in such a short time would not ordinarily be expected, an attempt was made to balance it by varying the order in which the dilution waters were used in each test. No variations in the initial counts obtained were observed, and it was concluded that the number of organisms in the sample did not change during this period.

RESULTS

The results secured in this comparative study of the bacterial counts obtained on samples from seven different sources, using six different dilution waters for each sample, are presented in Tables 2 to 8.

TABLE 2.—*Results with sample from White Clay Creek, Pine Ridge Indian Agency, Pine Ridge, S. Dak.*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	208	100	96	108
Distilled	196	100	70	67
Bicarbonate	215	100	60	50
Phosphate	220	100	89	86
Formula C	206	100	105	113
Cincinnati tap	214	100	93	102

TABLE 3.—*Results with sample from Lake Michigan near mouth of Chicago River, Chicago, Ill.*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	124	100	135	137
Distilled	133	100	86	59
Bicarbonate	117	100	80	51
Phosphate	137	100	86	84
Formula C	133	100	117	107
Cincinnati tap	129	100	103	95

TABLE 4.—*Results with sample from Goose Creek at Charleston, S.C.*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	152	100	97	98
Distilled	160	100	74	62
Bicarbonate	147	100	56	48
Phosphate	146	100	97	96
Formula C	149	100	95	97
Cincinnati tap	146	100	97	102

TABLE 5.—*Results with sample from Kansas River at Lawrence, Kans.*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	151	100	87	81
Distilled	130	100	95	82
Bicarbonate	128	100	83	70
Phosphate	140	100	93	85
Formula C	143	100	108	84
Cincinnati tap	138	100	97	85

TABLE 6.—*Results with sample from Saugus River watershed at Lynn, Mass.*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	380	100	99	105
Distilled	369	100	74	47
Bicarbonate	384	100	87	58
Phosphate	382	100	107	101
Formula C	392	100	101	104
Cincinnati tap	373	100	101	112

TABLE 7.—*Results with sample from Sangamon River, at Springfield, Ill.*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	213	100	105	106
Distilled	199	100	82	74
Bicarbonate	190	100	63	50
Phosphate	201	100	114	109
Formula C	211	100	108	106
Cincinnati tap	199	100	105	122

TABLE 8.—*Results with sample from Ohio River at Cincinnati, Ohio*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	27	100	93	96
Distilled	27	100	63	41
Bicarbonate	24	100	67	54
Phosphate	30	100	97	87
Formula C	27	100	89	100
Cincinnati tap	27	100	93	96

For convenience in comparing the results, the actual immediate counts have been given in each instance and the subsequent counts obtained at the 15 and 30 minute periods are expressed in percentages of the initial count. This was done in order that possible individual variations in the initial counts obtained with the different diluting waters might not influence the percentages. As a matter of fact, only slight variations were observed in these initial counts, for the average initial counts of the seven samples obtained with each dilution water were as follows: Cincinnati tap water, 175; phosphate water, 179; Formula C water, 180; bicarbonate water, 172; distilled water, 173; and the source waters, 179.

Apparently the relatively short exposure of 80 seconds, of the organisms in the sample to the dilution water before the immediate planting was made, was not sufficient to affect materially the results in any instance. However, when the results for the 15 and 30 minute exposure periods were considered, it is observed that both the bicarbonate and the distilled water gave very low results for both periods with all samples. This general agreement in the results from all samples makes it appear inadvisable to use either distilled or bicarbonate waters for bacteriological dilution at any time. The results obtained from all the samples with the other four dilution waters were about as consistent among themselves as would be expected. The average results for all samples with each dilution water are presented in Table 9.

TABLE 9.—*Average results with samples from all sources with each dilution water*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Source water	179	100	102	105
Distilled	173	100	78	62
Bicarbonate	172	100	73	55
Phosphate	179	100	100	96
Formula C	180	100	104	103
Cincinnati tap	175	100	99	106

Beyond a doubt the bactericidal influence of distilled water was due to the complete absence of mineral salts. Direct microscopic observations on living protozoön cells have shown that these cells are usually ruptured when they are placed in distilled water or in waters with a mineral salt concentration which varies widely from that of the medium in which the organisms are found. It is probable that many bacteria are similarly affected when they are placed in distilled water.

In the case of the bicarbonate water the bactericidal effect might be due to the low hydrogen ion concentration induced in part by heat sterilization, or to the toxicity of the bicarbonate water as prepared. To test this point, bicarbonate water (300 p. p. m.) was prepared in three ways: (1) By sterilizing distilled water and, after cooling and shaking, adding the required amount of sodium bicarbonate with aseptic precautions; (2) by filtration of the bicarbonate solution through a Berkefeld W filter; and (3) by the usual procedure of autoclave sterilization. The hydrogen ion concentrations, expressed in pH, for the three solutions thus prepared, were 8.1, 8.3, and 9.1, respectively. Using these three bicarbonate waters with sterilized Cincinnati tap water as a control dilution water, samples of Ohio River water were examined. The results obtained are given in Table 10.

TABLE 10.—*Results with sample from Ohio River at Cincinnati, Ohio, using bicarbonate dilution waters sterilized by various means*

Dilution waters used	Bacteria per ml. in the diluted sample after indicated intervals			
	Immediate		15 minutes, percent of initial	30 minutes, percent of initial
	Actual count	Percent		
Bicarbonate A[1]	48	100	67	62
Bicarbonate B[1]	48	100	110	100
Bicarbonate C[1]	49	100	98	90
Cincinnati tap	50	100	102	102

[1] The three bicarbonate waters used were sterilized as follows:
A, by autoclaving in regular manner.
B, by sterilizing distilled water and preparing solution with aseptic precautions.
C, by filtering through a Berkefeld W filter.
Control plates of all three waters were sterile.

These results indicate quite clearly that the bactericidal action of the bicarbonate dilution water was due to the low hydrogen ion concentration and not to the toxicity of the bicarbonate per se.

DISCUSSION

Two prerequisites of synthetic dilution waters for bacteriological use are indicated by the results obtained—the mineral salt content and the hydrogen ion concentration. The results with distilled water

indicate that the presence of some mineral salt is imperative. Of the mineral salts employed in this study, the amount, providing the concentration is within the range found in natural waters, and providing unfavorable hydrogen ion concentrations are not produced, does not appear to affect the results. Hydrogen ion concentrations as low as pH 8.2 were used without reducing bacterial numbers during a 30-minute period. However, at pH 9.0 a very marked decrease in bacterial numbers was observed after 15 minutes' exposure. This indicates that when mixed cultures of bacteria are being considered, many of the bacteria are killed or at least become inactive at a pH between 8.2 and 9.0.

At this point in the consideration of dilution water effects, distinction must be made between the death of the bacterial cell (as evidenced by an inability to grow when transferred from a dilution water to a suitable culture medium), and the ability to grow without lag in a medium diluted with such a water. Butterfield (1929) and Parsons et al. (1929) have shown that certain bacteria in dilute mediums grow best, and without lag, at a pH of about 7.0. Undoubtedly with mixed cultures of bacteria, as the hydrogen ion concentration changes from the zone of pH 7.0, where optimum growth is obtained, to the zone of pH 9.0, where bactericidal effects are observed, varying conditions of growth will be encountered. At the lower pH range the majority of the bacteria will grow well and without lag. In the intermediate zone, growth will occur but with increasing periods of lag. Finally, in the higher pH range many of the bacteria will fail to grow at all or may even be destroyed.

The evidence presented by Theriault et al. (1931, pp. 1099–1100) indicates that when distilled or bicarbonate dilution waters are used for biochemical oxygen demand determinations there is a decided lag in the oxidation rate for at least the first day of incubation. This lag was most marked in the higher dilutions, and the effect persisted longer with distilled water. In the same article (pp. 1112–1113) additional data are presented to show the influence of variations in seeding on biochemical oxygen demand results, being particularly marked during the first day of incubation and occasionally persisting to the end of a test. The data presented at this time, which show that in distilled and in autoclaved bicarbonate dilution water 40 to 50 per cent of the bacterial flora, added in polluted water, are rendered inactive in 30 minutes or less, offer a very probable explanation of the low oxygen demand results obtained when distilled water is used. In the case where unsterilized bicarbonate dilution water is used, the hydrogen ion concentration of the mixture, although not low enough to be bactericidal, is in the zone where a definite lag in the bacterial growth of mixed cultures is induced. Many of the bacteria present in sewage, and probably many protozoa also, find conditions in such

mixtures unsuitable for growth; they pass out of the field of action, and a lag of several hours intervenes before the residual organisms, which are able to survive and to grow, multiply in sufficient numbers to produce normal oxidation. Under such conditions not only is a lag produced by the limited activity during the first day of incubation but the biological flora and fauna acting may also be limited to a lesser number of species and the effect produced by this limitation would persist.

SUMMARY

In this study, in which the results obtained in the bacteriological examination of samples from seven widely separated locations in the United States are compared, using five different dilution waters which have been suggested, the following summary appears to be warranted:

1. Phosphate dilution water and Formula C water give the most consistent results.

2. With a view to the development of a dilution water which can be used for both bacteriological and oxygen demand tests, it seems desirable to standardize on the readily prepared phosphate water for further study, as it forms the basis for the more complete Formula C water.

3. In the bacteriological examination of natural waters the dilution water employed must contain some mineral salts. The amount of mineral salts required in the diluting water, within the range found in natural waters, does not appear to be critical so far as the survival of the bacteria is concerned. If growth of the bacteria, without lag, is desired, it is probable that a degree of mineralization corresponding to that of the natural water would be more favorable.

4. The hydrogen ion concentration of the dilution water also does not appear to require critical adjustment, providing it is not lower than pH 8.2, if survival of the bacteria for a short period only is desired. However if growth of the bacteria without lag is desired, a pH of 7.5 should probably not be exceeded.

5. Distilled water and dilution waters with hydrogen ion concentrations in the zone of pH 9.0 or lower are decidedly bactericidal.

6. In making tests on the suitability of dilution waters, the examinations should be made after the water has been sterilized, for the sterilization process may very greatly alter the characteristics of the water. This is particularly true for tap and bicarbonate waters.

7. Consideration must also be given to the glass container in which the dilution water is sterilized. Material dissolved from glass bottles of poor quality during autoclaving may make marked changes in the reaction and in the mineral salt content of the water.

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COURT DECISION RELATING TO PUBLIC HEALTH

Liability of city for sewage pollution of stream.—(United States Supreme Court; *City of Harrisonville* v. *W. S. Dickey Clay Mfg. Co.*, 53 S.Ct. 602; decided May 8, 1933.) Since 1923, the city of Harrisonville, Mo., had discharged the effluent from its sewage-disposal plant into a small stream at a point where it flowed through some pasture land owned by the appellee company. The disposal plant consisted of an Imhoff tank and a drainpipe, and it removed about 60 percent of the putrescible organic matter. The cost of the general sewerage system and disposal plant was about $60,000. A secondary disposal plant, which would have the effect of removing about 30 percent more of the putrescible organic matter, would cost from $25,000 to $30,000. The city's population was 2,000, but only about 1,400 of the inhabitants were served by the general sewerage system. In 1928, the clay manufacturing company, a Delaware corporation, brought suit in a Federal court in Missouri against the city, alleging injury to the pasture land through drainage of the effluent and seeking both damages and an injunction. The district court found that the aggregate loss in rental for 5 years was $500 and that it would cost $3,500 to restore the creek to the condition existing prior to the nuisance. Damages for $4,000 were, therefore, awarded, and in addition it was held that the company was entitled to an injunction, but the city was allowed 6 months within which to abate the nuisance

by introducing some method which would prevent the discharge of putrescible sewage into the creek. On appeal by the city to the circuit court of appeals, that court modified the decree by eliminating therefrom the item of $3,500 damages. The city then carried the case to the United States Supreme Court, not questioning the propriety of the award of $500 damages but contending that the injunction should have been denied. The Supreme Court took the view that complete monetary redress could be afforded the company "by making denial of an injunction conditional upon prompt payment, as compensation, of an amount equal to the depreciation in value of the farm on account of the nuisance complained of." The decree was reversed and the cause remanded to the district court for further proceedings to determine the depreciation in value and to enter a decree withholding an injunction if such sum be paid within the time to be fixed by that court. Portions of the Supreme Court's opinion follow:

First. The discharge of the effluent into the creek is a tort; and the nuisance, being continuous or recurrent, is an injury for which an injunction may be granted. Thus, the question here is not one of equitable jurisdiction. The question is whether, upon the facts found, an injunction is the appropriate remedy. For an injunction is not a remedy which issues as of course. Where substantial redress can be afforded by the payment of money and issuance of an injunction would subject the defendant to grossly disproportionate hardship, equitable relief may be denied although the nuisance is indisputable. This is true even if the conflict is between interests which are primarily private. * * * Where an important public interest would be prejudiced, the reason for denying the injunction may be compelling. * * * Such, we think, is the situation in the case at bar.

If an injunction is granted, the courses open to the city are (*a*) to abandon the present sewage disposal plant, erected at a cost of $60,000, and leave the residents to the primitive methods theretofore employed, if the State authorities should permit; or (*b*) to erect an auxiliary plant at a cost of $25,000 or more, if it should be legally and practically possible to raise that sum. That expenditure would be for a desirable purpose, but the city feels unable to make it. On the other hand, the injury to the company is wholly financial. * * * Denial of the injunction would subject the company to a loss in value of the land amounting, on the basis of the trial court's findings, to approximately $100 per year. That loss can be measured by the reduction in rental or the depreciation in the market value of the farm, assuming the nuisance continues, and can be made good by the payment of money. The compensation payable would obviously be small as compared with the cost of installing an auxiliary plant, for the annual interest on its cost would be many times the annual loss resulting to the company from the nuisance. Complete monetary redress may be given in this suit by making denial of an injunction conditional upon prompt payment, as compensation, of an amount equal to the depreciation in value of the farm on account of the nuisance complained of. We require this payment not on the ground that the nuisance is to be deemed a permanent one, as contended; but because to oblige the company to bring, from time to time, actions at law for its loss in rental would be so onerous as to deny to it adequate relief.

* * * This nuisance has at all times been removable by the device of secondary treatment of the sewage. It may be hereafter abated at any time by the State health authorities requiring such treatment. The city may itself conclude that this should be done in the public interest, financial or otherwise. Being so terminable, pollution of the creek cannot be deemed to be a permanent nuisance as of the date of the installation of the disposal plant in 1923.

DEATHS DURING WEEK ENDED MAY 27, 1933

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended May 27, 1933	Corresponding week, 1932
Data from 85 large cities of the United States:		
Total deaths	7,709	7,822
Deaths per 1,000 population, annual basis	10.8	11.2
Deaths under 1 year of age	573	652
Deaths under 1 year of age per 1,000 estimated live births [1]	48	52
Deaths per 1,000 population, annual basis, first 21 weeks of year	11.8	12.3
Data from industrial insurance companies:		
Policies in force	67,990,952	73,000,630
Number of death claims	12,224	13,176
Death claims per 1,000 policies in force, annual rate	9.4	9.4
Death claims per 1,000 policies, first 21 weeks of year, annual rate	10.7	10.4

[1] 81 cities.

173894°—33——2

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended June 3, 1933, and June 4, 1932

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 3, 1933, and June 4, 1932

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932
New England States:								
Maine	---	1	1	4	5	104	0	0
New Hampshire	---	1	---	---	118	35	0	1
Vermont	1	1	---	---	62	358	0	0
Massachusetts	27	38	---	2	539	1,009	1	2
Rhode Island	1	4	---	---	1	32	0	0
Connecticut	---	3	2	2	289	221	0	0
Middle Atlantic States:								
New York	30	91	[1] 10	[1] 10	2,094	2,150	5	6
New Jersey	20	25	1	7	946	769	2	1
Pennsylvania	52	63	---	---	1,257	1,629	0	14
East North Central States:								
Ohio	47	31	94	4	613	2,528	1	5
Indiana	13	15	25	14	211	125	3	5
Illinois [2]	34	51	10	58	702	1,083	29	8
Michigan	28	18	13	6	640	2,691	2	3
Wisconsin	6	5	26	30	330	1,570	1	0
West North Central States:								
Minnesota	8	4	1	3	248	88	3	1
Iowa	4	9	---	---	108	3	1	0
Missouri	15	23	2	2	196	61	4	7
North Dakota	3	3	---	---	268	20	0	1
South Dakota	---	4	---	---	17	13	1	0
Nebraska	3	8	---	---	44	7	1	0
Kansas	3	8	---	1	261	75	0	1
South Atlantic States:								
Delaware	---	1	2	---	14	---	0	0
Maryland [2 3 4]	6	5	2	3	50	33	1	1
District of Columbia [3]	2	7	1	---	19	20	1	0
Virginia	6	---	---	---	214	---	1	1
West Virginia	4	7	1	29	75	155	0	0
North Carolina	7	12	16	48	413	589	1	2
South Carolina [2]	9	5	100	249	252	214	0	0
Georgia [3]	1	4	---	30	---	35	0	1
Florida	3	4	7	1	39	6	0	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 3, 1933, and June 4, 1932—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932
East South Central States:								
Kentucky	-------	6	16	17	63	32	1	0
Tennessee	4	1	14	21	108	5	1	3
Alabama	6	9	14	32	56	8	1	3
Mississippi	4	4	-------	-------	-------	-------	0	0
West South Central States:								
Arkansas	3	-------	3	13	240	-------	0	0
Louisiana	4	20	18	6	30	5	0	1
Oklahoma [5]	9	9	3	32	130	19	0	0
Texas [3]	30	27	47	33	412	337	2	1
Mountain States:								
Montana [3]	1	1	-------	1	28	43	0	0
Idaho	-------	-------	-------	-------	43	-------	0	0
Wyoming [3]	-------	-------	-------	-------	13	55	0	1
Colorado	-------	10	23	-------	16	126	0	1
New Mexico	9	7	9	7	15	22	0	0
Arizona	2	2	2	6	111	1	0	0
Utah [4]	-------	-------	3	-------	48	2	0	0
Pacific States:								
Washington	4	8	-------	-------	57	183	0	1
Oregon [3]	1	4	17	27	47	221	1	0
California	38	60	29	41	1,128	264	0	1
Total	448	619	512	739	12,570	16,946	64	72

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932
New England States:								
Maine	0	0	18	7	0	0	1	2
New Hampshire	0	0	8	17	0	0	0	0
Vermont	0	0	7	15	0	4	0	0
Massachusetts	0	1	253	366	0	0	7	7
Rhode Island	0	0	28	45	0	0	0	0
Connecticut	0	2	54	76	0	0	3	1
Middle Atlantic States:								
New York	2	3	478	984	0	0	4	9
New Jersey	1	0	162	239	0	0	4	2
Pennsylvania	0	1	669	762	0	0	10	6
East North Central States:								
Ohio	0	3	1,039	328	7	23	24	8
Indiana	1	0	64	65	0	19	9	9
Illinois [3]	1	1	375	319	2	7	6	7
Michigan	1	1	349	503	0	9	4	3
Wisconsin	1	0	97	64	0	3	3	0
West North Central States:								
Minnesota	1	0	81	69	1	5	0	1
Iowa	0	0	17	22	14	16	1	1
Missouri	0	0	51	29	4	4	2	0
North Dakota	0	0	3	1	2	1	2	1
South Dakota	0	0	2	3	0	1	2	3
Nebraska	0	0	5	15	1	16	3	0
Kansas	0	0	31	24	2	5	1	0
South Atlantic States:								
Delaware	0	0	7	9	0	0	0	1
Maryland [2 3 4]	0	1	81	60	0	0	2	7
District of Columbia [3]	0	0	10	14	0	0	0	0
Virginia	0	2	39	-------	0	-------	11	-------
West Virginia	0	0	20	17	1	3	4	5
North Carolina	0	2	34	35	0	1	18	9
South Carolina [3]	0	2	1	7	0	0	30	20
Georgia [3]	0	0	2	2	0	0	21	19
Florida	0	0	0	0	0	0	2	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 3, 1933, and June 4, 1932—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932	Week ended June 3, 1933	Week ended June 4, 1932
East South Central States:								
Kentucky	3	0	27	18	1	1	12	15
Tennessee	1	1	23	17	1	30	11	13
Alabama	1	0	3	4	1	9	18	5
Mississippi	0	0	6	6	1	5	4	13
West South Central States:								
Arkansas	0	0	1	4	0	3	7	5
Louisiana	0	0	2	10	2	1	9	10
Oklahoma [5]	0	0	6	12	0	24	2	7
Texas [2]	1	1	38	30	12	48	18	3
Mountain States:								
Montana [3]	0	0	6	7	0	3	3	4
Idaho	0	0	6	1	2	0	0	0
Wyoming [3]	0	0	16	7	1	0	0	0
Colorado	0	9	29	16	0	1	0	2
New Mexico	0	0	5	11	0	2	3	3
Arizona	0	0	11	6	0	1	0	0
Utah [4]	0	0	7	2	0	0	0	0
Pacific States:								
Washington	0	0	40	26	1	10	0	6
Oregon [3]	0	0	25	10	12	15	4	0
California	0	3	132	141	28	9	5	8
Total	14	24	4,368	4,425	96	279	270	215

[1] New York City only.
[2] Typhus fever, week ended June 3, 1933, 23 cases: 2 cases in Illinois, 1 case in Maryland, 2 cases in South Carolina, 5 cases in Georgia, and 13 cases in Texas.
[3] Rocky Mountain Spotted fever, week ended June 3, 1933, 14 cases: 1 case in Maryland, 1 case in District of Columbia, 2 cases in Montana, 6 cases in Wyoming, and 4 cases in Oregon.
[4] Week ended Friday.
[5] Figures for 1933 are exclusive of Oklahoma City and Tulsa, and for 1932 are exclusive of Tulsa only.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
March 1933										
Colorado	4	28	----	----	552	----	0	173	3	4
April 1933										
Virginia	9	53	358	10	1,644	18	2	243	2	29
May 1933										
Connecticut	1	10	14	----	1,175	----	0	517	2	10
District of Columbia	1	12	1	----	98	2	0	51	----	1
Nebraska	2	13	----	----	747	----	0	73	5	2
New Mexico	----	25	11	7	40	3	0	31	1	10
North Dakota	----	8	22	----	403	----	0	33	3	2

Summary of monthly reports from States—Continued

March 1933

Colorado:
- Chicken pox 401
- Mumps 338
- Whooping cough 128

April 1933

Virginia:
- Chicken pox 388
- Diarrhea and dysentery 56
- Lethargic encephalitis 4
- Septic sore throat 23
- Tetanus 1
- Trachoma 1
- Typhus fever 1
- Undulant fever 9
- Whooping cough 158

May 1933

Chicken pox:
- Connecticut 766
- District of Columbia 100
- Nebraska 174
- New Mexico 49
- North Dakota 54

May 1933—Continued

Dysentery:
- Connecticut (bacillary) 5
- New Mexico 3

German measles:
- Connecticut 60

Lethargic encephalitis:
- North Dakota 1

Milk sickness:
- New Mexico 2

Mumps:
- Connecticut 364
- Nebraska 108
- New Mexico 77
- North Dakota 2

Ophthalmia neonatorum:
- Connecticut 1

Paratyphoid fever:
- Connecticut 1

Puerperal septicemia:
- New Mexico 3

Rabies in animals:
- Connecticut 13

May 1933—Continued

Septic sore throat:
- Connecticut 9
- New Mexico 1

Trachoma:
- Connecticut 2
- North Dakota 6

Trichinosis:
- Connecticut 1

Undulant fever:
- Connecticut 1
- Nebraska 2
- New Mexico 1

Vincent's angina:
- New Mexico 1

Vincent's infection:
- North Dakota 13

Whooping cough:
- Connecticut 264
- District of Columbia 34
- Nebraska 112
- New Mexico 103
- North Dakota 6

WEEKLY REPORTS FROM CITIES

City reports for week ended May 27, 1933

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Maine:											
Portland	0		0	2	2	7	0	3	0	9	26
New Hampshire:											
Concord	0		0	0	2	3	0	0	0	0	12
Nashua	0		0	0	0	0	0	0	0	1	
Vermont:											
Barre	0		0	0	0	0	0	0	0	6	1
Burlington	1		0	0	0	0	0	0	0	0	7
Massachusetts:											
Boston	3		1	297	22	83	0	8	1	24	214
Fall River	0		0	0	1	5	0	2	0	4	26
Springfield	0		0	2	1	10	0	1	0	16	32
Worcester	2		0	52	3	21	0	4	0	1	56
Rhode Island:											
Pawtucket	0		0	0	0	2	0	0	0	0	14
Providence	1		0	2	0	16	0	2	0	23	62
Connecticut:											
Bridgeport	0		0	33	1	12	0	4	0	1	32
Hartford											
New Haven	0		0	1	2	3	0	2	0	15	40
New York:											
Buffalo	5		0	85	14	53	0	5	0	33	140
New York	59	9	9	1,317	139	221	0	91	1	142	1,403
Rochester	1		0	2	4	26	0	0	0	11	69
Syracuse	0		0	3	4	14	0	0	0	7	47
New Jersey:											
Camden	1		0	17	3	11	0	0	0	0	35
Newark	0	1	0	154	7	11	0	11	1	43	121
Trenton	0		0	36	0	14	0	3	0	2	21
Pennsylvania:											
Philadelphia	6	2	2	509	20	85	0	23	1	3	429
Pittsburgh	2		0	7	10	80	0	4	0	48	135
Reading	0		0	17	2	7	0	0	0	3	24
Ohio:											
Cincinnati	2	2	2	10	10	30	0	9	0	13	133
Cleveland	8	46	0	4	6	138	0	11	0	30	140
Columbus	0	2	2	4	4	29	0	4	0	1	90
Toledo	1	1	0	211	4	129	0	6	0	6	77
Indiana:											
Fort Wayne	8		0	0	1	8	0	0	3	1	26
Indianapolis	0		1	120	10	15	0	3	0	12	
South Bend	0		0	1	1	1	0	1	0	4	9
Terre Haute	0		0	48	0	6	0	1	0	3	21

City reports for week ended May 27, 1933—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Illinois:											
Chicago	2		2	434	42	273	0	48	0	23	690
Cicero	0		0	18	0	4	0	0	0	0	3
Springfield	1		0	0	0	10	0	0	1	0	15
Michigan:											
Detroit	13	1	1	316	10	134	0	22	3	98	258
Flint	0	2	0	17	4	5	0	2	0	7	33
Grand Rapids	1		0	5	0	7	0	0	0	7	43
Wisconsin:											
Kenosha	0		0	4	1	2	0	0	0	21	7
Madison	0			38		2	0		0	0	
Milwaukee	1		0	6	6	51	0	7	0	53	105
Racine	0		0	0	1	5	0	1	0	19	14
Superior	0		0	1	0	0	0	0	0	14	6
Minnesota:											
Duluth	0		0	22	2	2	0	0	0	42	20
Minneapolis	2		1	42	4	41	0	1	1	47	87
St. Paul	0		0	178	0	22	0	2	0	68	62
Iowa:											
Des Moines	3			0		3	0		0	0	29
Sioux City	0			2		1	1		0	0	
Waterloo	0			3		2	1		0	0	
Missouri:											
Kansas City	2		0	39	5	26	0	5	0	1	75
St. Joseph	0		0	33	7	1	0	0	0	1	25
St. Louis	16	1	0	152	7	10	0	7	5	7	16
North Dakota:											
Fargo	0		0	0	0	0	0	0	0	0	9
Grand Forks	0		0	0	0	1	0	0	0	5	
South Dakota:											
Aberdeen	0		0	0	0	0	0	0	0	0	
Nebraska:											
Omaha	3		0	166	8	6	0	3	0	5	51
Kansas:											
Topeka	0		0	90	2	1	0	1	0	4	15
Wichita	1		0	1	0	1	2	1	0	10	24
Delaware:											
Wilmington	1		0	10	4	4	0	1	0	1	35
Maryland:											
Baltimore	3	2	1	13	12	78	0	13	1	33	188
Cumberland	0		0	13	2	0	0	0	0	0	11
Frederick	0		0	0	0	0	0	0	1	1	1
District of Col.:											
Washington	0		0	21	8	10	0	11	0	11	131
Virginia:											
Lynchburg	1		0	52	0	0	0	1	0	5	11
Norfolk	0		0	5	1	3	0	0	0	13	
Richmond	1		0	4	2	4	0	7	0	21	61
Roanoke	0		0	3	0	1	0	4	0	1	18
West Virginia:											
Charleston	0		0	0	0	2	0	1	0	1	9
Huntington	1		0	0	0	3	0	0	0	0	
Wheeling	0		0	5	0	3	0	0	1	1	8
North Carolina:											
Raleigh	0		0	4	0	4	0	1	0	0	13
Wilmington	0		0	29	0	0	0	1	1	1	9
Winston-Salem	0		0	13	0	5	0	2	0	2	7
South Carolina:											
Charleston	0		0	0	0	0	0	3	0	7	31
Columbia	0		0	0	1	0	0	1	0	0	8
Greenville	0		0	6	2	0	0	0	2	0	9
Georgia:											
Atlanta	2	7	1	27	0	0	0	2	6	44	63
Brunswick	0		0	0	0	0	0	0	0	0	1
Savannah	0	8	0	0	2	1	0	2	0	3	34
Florida:											
Miami	1		0	0	2	0	0	1	0	22	15
Tampa	0	2	2	0	1	0	0	1	0	0	34
Kentucky:											
Ashland	0		0	1	0	5	0	0	1	0	
Lexington	0		0	0	0	0	0	1	0	2	10
Louisville	2		0	19	5	16	0	2	0	3	67
Tennessee:											
Memphis	1		0	64	5	2	1	12	6	46	87
Nashville	0		1	7	1	0	0	1	1	1	40

City reports for week ended May 27, 1933—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Alabama:											
Birmingham	1		0	2	3	2	0	3	3	10	55
Mobile	0		1	2	0	0	0	1	0	0	22
Montgomery	0			6		0	0		0	7	
Arkansas:											
Fort Smith	0			0		1	0		0	0	
Little Rock	0		0	124	0	0	0	2	0	0	3
Louisiana:											
New Orleans	6	3	3	6	5	5	0	9	2	4	103
Shreveport	0		0	2	0	1	0	1	0	1	40
Oklahoma:											
Tulsa	0		0	68	0	2	0	0	1	21	
Texas:											
Dallas	3		0		0	8	5	4	0	0	63
Fort Worth	3		0	1	3	2	0	1	0	1	31
Galveston	0		0	0	2	0	0	0	0	0	17
Houston	4		1	0	4	1	0	5	1	0	65
San Antonio	0		2	11	3	0	0	7	0	0	83
Montana:											
Billings	0		0	0	0	0	0	0	0	0	4
Great Falls	0		0	1	1	0	0	0	1	0	4
Helena	0		0	0	0	0	0	0	0	0	1
Missoula	0	1	1	26	0	0	0	0	0	0	8
Idaho:											
Boise	0		0	1	0	0	0	0	0	0	6
Colorado:											
Denver	1	23	0	7	8	12	0	7	1	3	72
Pueblo	0		0	0	0	1	0	0	0	3	8
New Mexico:											
Albuquerque	1		0	12	1	0	0	1	1	0	9
Utah:											
Salt Lake City	0		0	17	1	3	0	0	0	30	22
Nevada:											
Reno	0		0	0	0	0	0	0	0	0	
Washington:											
Seattle	0			1		16	0		0	9	
Spokane	0			0		3	0		0	0	
Tacoma	0		1	2	2	2	0	0	0	0	25
Oregon:											
Portland	0		0	3	4	6	3	2	0	3	57
Salem	0		0	7	0	1	0	0	0	0	
California:											
Los Angeles	20	16	3	376	7	43	8	23	0	56	278
Sacramento	0		0	2	3	1	0	7	0	81	
San Francisco	3	1	1	3	6	5	0	17	1	81	175

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Maine:			
Portland	1	1	0
New York:			
New York	3	4	2
New Jersey:			
Newark	1	0	0
Ohio:			
Cleveland	1	0	0
Indiana:			
Indianapolis	3	2	0
Illinois:			
Chicago	18	4	0
Michigan:			
Detroit	1	0	0
Wisconsin:			
Milwaukee	1	2	1
Minnesota:			
St. Paul	0	1	0
Missouri:			
St. Louis	1	1	0
Nebraska:			
Omaha	1	0	0
Georgia:			
Atlanta	1	1	0
Washington:			
Seattle	2	0	1
Oregon:			
Portland	0	0	1
California:			
Sacramento	1	0	0

Lethargic encephalitis.—Cases: New York, 2; Philadelphia, 1; Detroit, 1.
Pellagra.—Cases: Baltimore, 1; Washington, 1; Wilmington, 1; Charleston, S.C., 1; Montgomery, 1; New Orleans, 2; Los Angeles, 1; Sacramento, 1; San Francisco, 1.
Typhus fever.—Cases: Charleston, S.C., 1; Savannah, 1; Mobile, 1; Houston, 1.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—2 weeks ended May 20, 1933.—The Department of Pensions and National Health of Canada reports cases of certain communicable diseases for the 2 weeks ended May 20, 1933, as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis			2	1	1					4
Chicken pox		13	27	329	420	52	54	11	134	1,040
Diphtheria		2	4	46	6	11	2	2	3	76
Erysipelas				7	12	3		6	2	30
Influenza		3		5	4				16	28
Measles	3	5	15	499	335	6	5		23	891
Mumps		1			395	50	30		64	540
Paratyphoid fever					6					6
Pneumonia		10			19		8		5	42
Poliomyelitis			1	1	1			1		4
Scarlet fever		11	2	103	133	15	13	13	13	303
Smallpox					1		5		1	7
Trachoma									25	25
Tuberculosis	10	7	11	164	48	22	37	5	46	350
Typhoid fever			3	60	14	6	1	1	3	88
Undulant fever					2					2
Whooping cough				112	191	89	22	11	17	442

CUBA

Provinces—Communicable diseases—4 weeks ended April 29, 1933.—During the 4 weeks ended April 29, 1933, cases of certain communicable diseases were reported in the provinces of Cuba as follows:

Disease	Pinar del Rio	Habana	Matanzas	Santa Clara	Camaguey	Oriente	Total
Chicken pox	1	4	1	3	5	8	22
Diphtheria		5	1	8	1	1	16
Malaria	1	4	14	51	46	25	141
Measles		2	19	10	4	5	40
Scarlet fever	1						1
Tetanus, infantile	1				1	1	3
Tuberculosis	3	27	21	29	7	41	128
Typhoid fever	5	7	9	30	8	19	78

DENMARK

Communicable diseases—January–March 1933.—During the months of January, February, and March 1933, cases of certain communicable diseases were reported in Denmark as follows:

Disease	Cases		
	January	February	March
Cerebrospinal meningitis	3	7	4
Chicken pox	63	45	68
Diphtheria and croup	378	214	204
Erysipelas	286	249	281
German measles	11	25	30
Gonorrhea	853	721	760
Influenza	43,063	51,273	25,530
Lethargic encephalitis	5	4	10
Measles	1,649	1,427	1,603
Mumps	408	328	561
Paratyphoid fever	4	10	17
Poliomyelitis	3		3
Puerperal fever	11	13	16
Scabies	985	718	803
Scarlet fever	264	161	240
Syphilis	61	58	56
Tetanus	4		1
Typhoid fever	1	3	1
Undulant fever (Bact. abort. Bang)	42	39	32
Whooping cough	1,619	1,422	1,236

FRANCE

Vital statistics—Years 1931 and 1932.—During the years 1931 and 1932, births, deaths, marriages, and divorces, were reported in France as follows:

	1931	1932
Number of marriages	326,538	314,878
Number of divorces	21,212	21,848
Number of live births	730,249	722,246
Stillbirths	28,058	27,537
Number of deaths	680,710	660,882
Deaths under 1 year of age	55,444	55,177

NOTE.—The population of France was estimated as 41,835,000 during 1931.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

(NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for May 26, 1933, pp. 586-596. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued June 30, 1933, and thereafter, at least for the time being, in the issue published on the last Friday of each month.)

Cholera

Philippine Islands.—During the week ended June 3, 1933, cholera was reported in the Philippine Islands as follows: Province of Bohol, 40 cases, 20 deaths; Province of Cebu, 1 case.

During the 3 weeks ended May 20, 1933, 29 cases of cholera with 23 deaths were reported in the Island of Samar, Philippine Islands.

Smallpox

Bolivia.—During the month of April 1933, 18 cases of smallpox were reported at La Paz, Bolivia; 3 cases at Potosí; several cases in the Department of Potosí; and isolated cases in the Department of Chuquisaca, Bolivia.

Mexico.—During the latter part of May 1933, smallpox was reported in the vicinity of Camaron, Mexico. Camaron is on the Don Martin Dam (or lake), about 70 miles by highway southwest of Nuevo Laredo, Mexico.

Typhus Fever

Bolivia.—During April 1933, 167 cases of typhus fever were reported in La Paz, Bolivia; several cases in the Department of La Paz; isolated cases in Cochabamba; 14 cases in Oruro; and 9 cases in Potosí, Bolivia.

Mexico.—During the latter part of May 1933, cases of typhus fever were reported in the vicinity of Camaron, Mexico.